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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Shigemasa Ishihara

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EXAMINER

TRAN, BINH X

ART UNIT

PAPER NUMBER

1785

DATE MAILED: 02/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/779,645

Applicant(s)

ISHIHARA, SHIGENORI

Examiner

Binh X Tran

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 November 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 32 and 33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-33 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-848)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Paper No(s)/Mail Date: _____
- 6) ☐ Notice of Informal Patent Application (PTO-152)
- 7) ☐ Other: _____
- Response(s)/Mail Date 05-10-2004
- 07-03-2004

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I (claim 1-32) in Paper received on 11-06-2003 is acknowledged. The traversal is on the ground(s) that "a search for Group I is believed to include the apparatus of Group II and employing the apparatus of Group II will employ the subject matter of Group I". This is not found persuasive because the process as claimed (Group I) can be practiced by another materially different apparatus such as using an apparatus without having a gas-controlling device.
2. The applicants also request to rejoin the claim of Group II (i.e. claims 32-33) under MPEP §821.04, once the claims of Group I are allowable. This is not persuasive because the MPEP §821.04 only applied if applicant elects claims directed to the product, and a product claim is subsequently found allowance, the withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined.
3. Claims 32-33 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper received on 11-06-2003.

The requirement is still deemed proper and is therefore made FINAL.

Specification

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 6-7, 16-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6-7, 21-22 are indefinite for improper use of Markush language. The examiner suggests replacing "at least one selected from" to --at least one selected from the group consisting of--.

In claims 16-20, "the organic substance removing step of removing the ion-implanted organic substance" (emphasis added) lack antecedent basis. The examiner recognizes that the applicants disclose the step of "implanting ions" is performed before the organic substance-removing step. However, the applicants only disclose that the ions implant into the semiconductor region using the organic substance as a mask. There is no limitation in the claims indicating that the organic substance was implanted with ions.

Claims 21-31 are indefinite because they directly or indirectly depend on indefinite claims 16-20.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 3, 5-7, 9, 13-15, 18, 20-22, 24, 27-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Kurimoto (US 6,043,004).

Respect to claim 3, Kurimoto discloses a method for removing organic substance (i.e. photoresist) having an ion-implanted region, from above the substrate, the method comprising:

the first step of introducing oxygen-containing gas, a hydrogen-containing gas and a fluorine-containing gas into the reaction chamber to effect a plasma process (col. 5 lines 55-67, Fig 2);

the second step of introducing the same gas component as the first step (i.e. oxygen, hydrogen and fluorine), wherein the oxygen amount is increased (col. 6 lines 15-26, Col. 8 lines 24-27, Fig 5A-5B).

Since the amount of oxygen is increased in the second step, the concentration of the fluorine in the second step must be lower than the concentration of fluorine in the first step. Further Kurimoto teaches to control such as lower the concentration of CF₄ in

order to avoid the etching of underneath layer silicon oxide film during the second step (col. 7 lines 23-25)

Respect to claim 5, Kurimoto discloses that the amount and concentration of fluorine gas determine whether the exposed oxide film on the substrate is etched or not (col. 7 lines 22-25). As discussed above, since the concentration of fluorine in the second step is lower than the first step, the second gas must be less prone to etch an exposed surface of substrate than the first step.

Respect to claim 18, Kurimoto further discloses the step of forming a patterned organic substance (i.e. resist layer 52) on a semiconductor substrate and implanting ions into the semiconductor region using the organic substance as a mask (col. 5 lines 33-43). The limitation of claim 20 has been discussed above.

Respect to claims 6, 21 Kurimoto discloses the fluorine-containing gas is CF_4 (col. 5 lines 63, read on "carbon fluoride"). Respect to claims 7 and 22, Kurimoto discloses hydrogen-containing gas is H_2 . Respect to claim 9 and 24, Kurimoto discloses second temperature is higher than the first temperature (See Fig 4, read on "heating temperature of the substrate in the first step is not higher than heating temperature of the substrate in the second step"). Respect to claims 12 and 27, Kurimoto teaches the elapsed time in the first step is measured and the process is transfer to the second step (See Fig 6, line label number "1" and number "2"). Respect to claims 13 and 28, Kurimoto teaches a region deteriorated by ion implantation is completely remove, before the process is transferred to the second step (col. 8 lines 7-14). Respect to claims 14 and 29, Kurimoto teaches the first and second steps are

Art Unit: 1765

performed in the common chamber. Respect to claims 15 and 30, Kurimoto teaches the organic substance is a resist (aka photoresist) having photosensitive resin. Respect to claim 31, Kurimoto discloses the substrate comprises a surface comprised at least silicon or silicon compound, exposed out from the organic substance (52) (Fig 5A).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1, 6-7, 9-10, 12-16, 21-22, 24-25, 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurimoto in view of Kuo et al. (US 6,024,887).

Respect to claims 1 and 16, Kurimoto fails to explicitly disclose that there is no fluorine-containing gas in the second step. In a photoresist removal method, Kuo teaches to use oxygen-containing gas. Kuo further discloses the second etchant composition comprises oxygen without the fluorine-containing gas (col. 12 lines 17-23). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Kurimoto in view of Kuo, by using a etchant composition without fluorine-containing gas in the second step because it would increase the surface uniformity.

Claims 10 and 25 differ from Kurimoto by further specifying that fluorine is implanted from the plasma into the organic substance having phosphorous, arsenic or boron implanted thereto in the first step. However, Kurimoto clearly discloses the

organic substance (i.e. photoresist) has phosphorous, arsenic or boron ion implanted thereto. Further Kurimoto discloses the first plasma comprises fluorine-containing species. Kuo discloses fluorine is implanted from the plasma into the organic substance (col. 12 lines 13-17). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Kurimoto in view of Kuo by implanting fluorine into the organic substance because this would prevent damage to the substrate.

The limitation of multiple dependent claims 6-7, 9, 12-15, 21-22, 24, 27-31 have been discussed above under Kurimoto's reference.

11. Claims 4, 6-7, 9, 11-15, 19, 21-22, 24, 26-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurimoto in view of Nakayama et al. (US 5,795,831).

Respect to independent claims 4 and 19, Kurimoto fails to explicitly disclose that hydrogen concentration in the second step is higher than hydrogen concentration of the first step. In a removing method, Nakayama teaches two etching steps comprise at least an oxygen-containing gas. Nakayama further discloses the hydrogen concentration in the first step is 0.1 % (col. 4 lines 53-55). In the second step, Nakayama discloses using the process gas comprises 1000 sccm O₂, 30 sccm of CF₄ or NF₃, and 10 sccm of N₂H₂ to enhance residues removing process. Any person having ordinary skill in the art would be able figure out that the concentration of hydrogen approximately equals 0.96 % ($= [10 / (1000 + 30 + 10)] * 100\%$). Base on this result, the examiner interprets that Nakayama implicitly teaches the concentration of hydrogen in the second step is higher than concentration of hydrogen in the first step. It would have been obvious to one having ordinary skill in the art, at the time of invention,

to modify Kurimoto in view of Nakayama, by having the hydrogen concentration in the second step greater than the first step because it will reduce the amount of residues.

The limitation of multiple dependent claims 6-7, 9, 12-15, 21-22, 24, 27-31 have been discussed above under Kurimoto's reference.

Respect to claims 11 and 26, Nakayama teaches to monitor the light emission between the two steps in order to determine to endpoint. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Kurimoto in view of Nakayama by monitoring the light emission from the plasma because it will help to determine the endpoint of each plasma process.

12. Claims 6-9, 12-15, 21-22, 23-24, 27-31 are are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurimoto in view of Bar-Gadda (US 5,824,604).

The independent claims 8 and 23 differ from Kurimoto by further specifying the plasma density in the first step is not less than $1 \times 10^{11} \text{ cm}^{-3}$. However, Kurimoto teaches that plasma density is a result effective variable. In a photoresist removal method, Bar-Gadda discloses that the plasma density is a result effective variables range from $1 \times 10^{16} \text{ cm}^{-3}$ to $1 \times 10^{17} \text{ cm}^{-3}$ (col. 9 lines 17-22, within applicants' range). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art, to perform routine experiment to obtain optimal plasma density value.

The limitation of multiple dependent claims 6-7, 9, 12-15, 21-22, 24, 27-31 have been discussed above under Kurimoto's reference.

Art Unit: 1765

13. Claims 2, 6-7, 9, 12-15, 17, 21-22, 24, 27-31, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kurimoto in view of Kajitani et al. (US 5,688,410).

The independent claims 2 and 17 differ from Kurimoto by further specifying that the concentration of fluorine-containing gas is not more than 0.01 vol.%. In a photoresist removal method, Kajitani discloses the concentration of fluorine containing gas is a result effective variable and it can be varied from 0-10 % (Fig 2, overlap with applicants' range). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiments as suggest by Kajitani in order to obtain optimal percentage of fluorine-containing gas.

The limitation of multiple dependent claims 6-7, 9, 12-15, 21-22, 24, 27-31 have been discussed above under Kurimoto's reference.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone

Art Unit: 1765

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

